2.0 Configuration Management Baseline

Evidence of effective configuration management (CM) and configuration control (CC) processes should provide a model user with reasonable assurance that sound software management and development practices are in place for a particular model. A controlled, logical process for the maintenance of software should allow users to report suspected errors to and request needed enhancements from the controlling organization, which should also give serious consideration to their recommendations. There are comprehensive, documented CM and CC processes in effect for ALARM. The *ECSRL Software Configuration Management Plan* [7] documents the specific procedures followed in processing, approving, and implementing changes to the baseline.

ALARM is an established model, originally implemented in 1974 by CALSPAN for what has become Wright Laboratory's Electronic Combat Simulation Research Laboratory (ECSRL) at Wright-Patterson AFB, OH. The software and documentation are distributed through the Survivability/Vulnerability Information Analysis Center (SURVIAC), which maintains CC of the version that is distributed to the user community.

The current baseline is version 3.1 and is comprised of two software components: the ALARM code itself, and a group of eight utility support programs. ECSRL maintains and controls the documentation that is updated and released with each new baseline version. These include a user's manual [4], a programmer's manual [5], and an analyst's manual [6]. User organizations must sign a Beta Site Agreement with ECSRL before receiving the code. The Agreement allows users to modify the code to meet their own needs, but requires them to report all anomalies and changes to the ALARM Configuration Control Board (CCB). The CCB membership consists of Air Force managers at ECSRL and selected support staff personnel.

The existence of support functions is often important to users. The availability of technical experts to answer questions, input data sets for commonly modeled radars and targets, documentation to describe the model's algorithms, and access to other users who may have used the model to solve similar problems, all contribute to the users' confidence they can complete their own analyses using the model. Technical support for ALARM is available from both SURVIAC and ECSRL. The ALARM Users Group meets at least annually and more than 20 organizations are usually represented at a typical meeting. SURVIAC distributes ALARM with input data files for 16 different example problems. ECSRL is presently building classified radar data files for some twenty radars that will be made available to authorized users.

In summary, ALARM has many users, available user support, and a history of wide application to DoD analysis efforts. The following sections further describe the development history of ALARM, its current version status, change procedures, and user support functions. Table 2.0-1 provides a summary of ALARM CM status information.

Figure 2.0-1 ALARM Configuration Management Summary

C/M Characteristic	Status
Model Baseline Version	ALARM 3.1
Sponsoring Organization POC	WL/AAWA-1 ECSRL Wright-Patterson AFB, OH 45433 Mr. Rob Ehret voice: (513) 255-2164 fax: (513) 476-4658 e-mail: ehretra@aaunix.aa.wpafb.af.mil
Supporting Organization POCs	SURVIAC Wright-Patterson AFB, OH 45433 Technical POC Denny Dettamore (Booz-Allen & Hamilton/Dayton) voice: (513) 429-9509 fax: (513) 429-9795 e-mail: Detamore_Denny@bah.com Administrative POC Sue Green (Booz-Allen & Hamilton/Dayton) voice: (513) 255-4840 fax: (513) 255-9673 e-mail: Green_Sue@bah.com
Configuration Controlled	Yes, at model level
Documented CM Plan	Yes
Documented CM Procedures	Yes
Organized Users Group	Yes
User Group Meeting Frequency	Annually

2.1 MODEL DESCRIPTION

ALARM is a digital computer simulation designed to determine the detectability of a single target by a single radar. It is an integration period model, in which signal processing is accounted for by deterministic mathematical formulation or by recursive algorithm. The purpose of the model is to provide the analyst with a tool to study radar detectability phenomena via simulation of moving target indicator (MTI), pulse doppler, and continuous-wave (CW) radars. A jamming module provides a means for determining burn-through ranges for noise jamming scenarios and jamming-to-signal (J/S) ratio for coherent jamming scenarios.

ALARM radar detection calculations are based on the signal-to-noise (S/N) radar range equations commonly used in radar analysis. Engineering theory in ALARM is based on that given in popular radar textbooks, such as *Radar Range Performance Analysis* by Lamont V. Blake [14] and *Introduction To Radar Systems, 2nd Edition* by Merrill I. Skolnik [15]. The model addresses the environmental effects of atmosphere, terrain masking, clutter, and multipath on electromagnetic propagation. Land clutter reflectivity probability distributions published by Massachusetts Institute of Technology (MIT) Lincoln Laboratory and sea clutter reflectivity probability distributions from the Center for Naval Analyses (CNA) are used in ALARM 3.1.

2.1.1 Model Mission

The mission statement specified in the *Operational Concept Document for ALARM 3.1* [6] defines the intended usage of the model as follows:

> The primary mission of ALARM 3.1 is to provide areas of detectability by a single radar and to aid the radar analyst in the understanding of detectability phenomena.
>
> The secondary mission of ALARM 3.1 is to provide radar detection contours or detection flight path histories to higher-order models.

2.1.2 Model Functions and Characteristics

ALARM is a generic radar detection model whose functionality is controlled by user-defined inputs. These functionalities can be divided into seven areas, as shown in the Functional Area Template, Figure 2.1-1, and summarized below:

1. Target Characteristics: The user can specify target flight path, including location, speed, and attitude; static and rotor radar cross section (RCS); RCS fluctuations, using the various cases defined by Peter Swerling [21]; and several electronic countermeasure (ECM) techniques. ECM can include on-board deception jamming, on-board noise jamming, or stand-off noise jamming, with up to five stand-off jammers.

2. Signal Propagation: The effects of terrain masking are based upon the Defense Mapping Agency (DMA) Digital Terrain Elevation

Data (DTED) Type I terrain files that can be input to a model run. The user can also specify parameters controlling the generation of clutter signals and multipath/diffraction interference. ALARM includes a standard day model of atmospheric attenuation, based on radar frequency and elevation angle. It also uses a refraction factor that can be set by the analyst to represent different conditions. This factor is normally set to the value 4/3, hence the expression "four thirds earth." ALARM calculates the strength of the radar and jamming signals over types of terrain using the Spherical Earth/Knife Edge (SEKE) diffraction and multipath algorithms developed by MIT's Lincoln Laboratory.

3. Transmitter: The radar waveform generated is specified through user-defined inputs covering frequency, pulse repetition frequencies (PRFs), pulse width, pulse compression ratio, number of pulses integrated, and other factors.

4. Receiver: ALARM explicitly models thermal noise, based on an ambient air temperature of 290° K. The analyst can choose between a linear and square law detector model, and can specify the receiver recovery time used for blanking. ALARM does not explicitly model automatic gain control (AGC), thus assuming a receiver with an instantaneous response.

5. Antenna: The analyst can choose between two- or three-dimensional antenna gain patterns, using either the same or different patterns for receive and transmit antennas. Antenna scan is not modeled; rather, ALARM assumes perfect antenna pointing (i.e., the antenna always points directly at the target). For radars with fixed or restricted elevation angles (e.g., early warning and height-finder radars), the user can specify the maximum and minimum elevation angles.

6. Signal Processing: ALARM uses an algorithm developed by Peter Swerling to define the detection threshold over an integration period [21]. This logic accommodates target signal fluctuations. Clutter rejection can be modeled using either MTI or doppler (Chebychev) filters. Filter effects such as blind speeds (doppler) are considered, as well as other filter effects caused by the number of MTI delays or doppler filters and their characteristics. Effects due to pulse eclipsing/blanking, MTI range and azimuth gating, and pulse compression

are also included. The Swerling threshold logic accommodates integration of signals over some user-specified number of pulses received.

7. Target Tracking: ALARM is an initial detection model, and as such performs no explicit target tracking function. Because the model assumes perfect pointing, it also assumes perfect tracking.

RF Sensor Functional Area Template (FAT)

1.0 Target Characteristics
- 1.1 Flight Path
- 1.2 Signature
  - 1.2.1 RCS
    - 1.2.1.1 Static
    - 1.2.1.2 Dynamic
  - 1.2.2 Fluctuations
- 1.3 ECM
  - 1.3.1 Noise
    - 1.3.1.1 On Board
    - 1.3.1.2 Off Board
    - 1.3.1.3 Standoff
  - 1.3.2 Deceptive
    - 1.3.2.1 On Board
    - 1.3.2.2 Off Board
    - 1.3.2.2 Standoff

2.0 Propagation
- 2.1 Masking
- 2.2 Clutter
- 2.3 Multipath / Diffraction
- 2.4 Atmospheric Attenuation

3.0 Transmitter
- 3.1 Waveform Generator

4.0 Receiver
- 4.1 Thermal Noise
- 4.2 AGC
- 4.3 Detector
- 4.4 Blanking

5.0 Antenna
- 5.1 Antenna Gain
- 5.2 Antenna Scan

6.0 Signal Processing
- 6.1 Threshold
- 6.2 Clutter Rejection
  - 6.2.1 MTI
  - 6.2.2 Doppler Filters
- 6.3 Integration
- 6.4 Pulse Compression

7.0 Target Tracking
- 7.1 Angle
- 7.2 Range
- 7.3 Doppler

Figure 2.1-1 Functional Area Template, RF Sensor[1]

1. The Functional Area Template is central to the SMART process for verification and validation (V&V). A real-world system is decomposed into functional areas, which are further decomposed into functional elements (FEs). As an example, Target Characteristics is a functional area in an RF Sensor. FEs within Target Characteristics are Dynamic RCS and Signature Fluctuations. SMART process V&V activities focus on individual FEs.

2.2 DEVELOPMENT HISTORY

ALARM was initially developed in 1974 by CALSPAN in Buffalo, NY, under the sponsorship of the Air Force Avionics Laboratory (AFAL) located at Wright-Patterson AFB, OH. It was built for the Penetration Aids Evaluation (PENVAL) program, and the original version had randomly distributed clutter based upon a user-input clutter coefficient. MTI and doppler processing were implemented by using a single input value for clutter suppression. The model was designed for operation on CALSPAN's IBM mainframe computer, which had a custom-designed operating system. ALARM was not easily transportable to other computer platforms at that time.

The historical ALARM baselines described below were implemented by SAIC under contract to the Air Force office now known as Wright Laboratory, Electronic Warfare Requirements and Analysis Branch, WL/AAWA also located at Wright-Patterson AFB, OH. Specific modifications and/or enhancements applicable to each version provide a history of model developments since 1980.

ALARM 80: The MTI, doppler clutter filters, stand-off jamming, and sensitivity time control (STC) algorithms were improved.

ALARM 84: Site-specific DMA DTED processing was added. Model users had a choice of using òsite-specificó or òround smooth earthó terrain representations.

ALARM 86: Lincoln Laboratory's new clutter model was added to ALARM, and the Air Force Electronic Combat Office (AFECO) included the model in the Electronic Combat Digital Evaluation System (ECDES). This version of the model was the first to be subjected to strict configuration control, and it was the first version placed in SURVIAC for distribution. In 1987, AFECO mandated the use of ECDES models, including ALARM 86, for use in all Air Force analyses related to Electronic Combat.

ALARM 88: The code was restructured, joining what had become two separate executable codes-- "site specific" and "round smooth earth"-- into one model.

ALARM 91: Lincoln Laboratory's SEKE algorithms to calculate low-level propagation effects were incorporated.

ALARM 92: In this beta version of ALARM 3.0, the CNA sea clutter algorithm and three-dimensional antenna patterns were added.

ALARM 3.0: This version was issued in August 1993. The following paragraphs describe the major changes made to ALARM for this version:

1. The capability to input and utilize three-dimensional (3-D) radar transmit and receive antenna patterns was added.

2. A sea clutter reflectivity algorithm and input data to allow for the pattern propagation factor over the sea were incorporated.

3. The capability to model up to five stand-off jammers (SOJs), each with a unique platform location and jammer characteristics, was added.

4. The input of target altitude was changed to allow specification as either mean sea level (MSL) or above ground level (AGL) when ALARM executes in Contour Plot mode.

5. Signal processing was made more realistic and efficient.

6. The interaction between model-computed detection threshold and user-specified target fluctuation model was improved.

7. Deception jamming was redesigned to be more effective when the deception jamming-to-target signal ratio (J/S) is greater than the user-supplied value.

8. The program logic was redesigned to obtain a more optimal execution speed.

9. A binary post-processor output file was made available for executing ALARM in Flight Path mode.

10. The probability of detection associated with signal-to-interference ratio for each contour point was added to the end of the data in the binary plot file.

11. ALARM was made fully compatible with UNIX operating systems.

12. Identified problems or errors in the ALARM 91 version were corrected.

ALARM 3.1: This is the current baseline version, released in September 1995, and distributed by SURVIAC. Major enhancements and changes made to ALARM for this version include:

1. Addition of Coherent Integration Gain. Previous versions of ALARM determined only non-coherent integration gain, which is incorrect for radar receivers that coherently integrate return pulses (e.g., pulse doppler radars).

2. Negative Sub-Pulse Width in Clutter Calculations. Previous versions of ALARM incorrectly limited the sum of the illuminated lengths of the clutter patch on the ground to the radar's range resolution, identified in SMART Model Deficiency Report (MDR) 29. For particular combinations of radar characteristics and geometries, this error results in the determination of a negative illuminated length of a clutter patch. The contribution of this clutter patch to the overall clutter signal level is also negative, thus reducing the overall clutter signal. The clutter from each illuminated clutter patch is now determined only for clutter patches with positive illuminated lengths.

3. Pulse Compression Processing Gain for Pulse Doppler Radars. Previous versions of ALARM incorrectly determined the gain associated with pulse compression processing for pulse doppler radars. Pulse compression processing is performed before doppler filter processing and the bandwidth of the pulse compression processor should be wide enough to pass the bandwidth of the compressed pulse. Thus, the bandwidth of the pulse compression processor is now accounted for when determining the processing gain for a pulse doppler radar.

4. Off-Axis Antenna Gain from 2-D Antenna Gain Patterns. Previous versions of ALARM determined the off-axis antenna gain for 2-D antenna gain patterns from the user-supplied azimuth and elevation plane antenna gain patterns based on the approach discussed in *Introduction to Radar Systems* [15]. While this approach is widely supported in antenna references, it produces non-optimal off-axis antenna gain patterns. The approach used in ALARM 3.1 involves determining the azimuth and elevation plane contributions to the off-boresight gain as a function of the solid angle between the azi-

muth and elevation look-up angles and the root sum-of-squares value of the azimuth and elevation look-up angles.

5. Doppler or MTI Filter Response to Clutter Power Spectral Density. Previous versions of ALARM divided the numerical integration of the doppler filter's or MTI system's frequency response with the clutter power spectral density in multiple steps. SMART MDR 35 identified using multiple steps as an error due to particular features of the Romberg numerical integration routine used in ALARM. In ALARM 3.1, the integration is conducted in one step covering the entire frequency range of interest.

6. Average Gain of the MTI System. Previous versions of ALARM determined the average gain of the MTI system based on a closed-form equation from *MTI and Pulse Doppler Radar* [16]. This equation is not correct for non-block staggered pulse repetition frequency MTI systems (multiple PRFs with two or less delays). In ALARM 3.1, the average gain of an MTI system is determined by numerically averaging its frequency response over the receiver's noise bandwidth.

7. Several minor problems with ALARM 3.0 were identified in problem reports generated by the Electronic Warfare Requirements and Assessments Program, MDRs from the SMART Program, and Change/Error Notification Forms submitted by users. Notable problems corrected in ALARM 3.1 included:

   - Limits on the input variables for probability of detection and probability of false alarm were changed to reflect their correct values for the algorithm used in the detection theory subroutine THRESH. (SMART MDR 31)

   - Documentation associated with sea-state definitions (SMART MDR 33), detection theory and the use of automatic detection algorithms in ALARM (SMART MDR 43), and number of pulses integrated (SMART MDR 44) was clarified.

   - The "Target Status Msk or Unmsk" output was corrected for the Flight Path mode text output file to reflect the masking status of the target when executing a scenario with stand-off jamming. (SMART MDR 60)

- The radar detection text contained in the MSKOUT(I) output variable for the Flight Path mode text output file was expanded to show the effectiveness of on-board and/or stand-off jammer(s). (SMART MDR 64)

2.3 VERSION DESCRIPTION AND STATUS

The following paragraphs describe the ALARM Computer Software Configuration Items (CSCIs), including source code, documentation, and databases. The version designator for the current baseline is ALARM 3.1. Configuration control is exercised at the model level, which means that updated versions are released as a package, not through partial updates.

The documents listed below provide the formal documentation set applicable to the ALARM 3.1 version baseline.

Software User's Manual: *Software User's Manual for the Advanced Low Altitude Radar Model (ALARM 3.1)*, June 1995, UNCLASSIFIED [4].

Software Programmer's Manual: *Software Programmer's Manual for the Advanced Low Altitude Radar Model (ALARM 3.1)*, June 1995, UNCLASSIFIED [5].

Software Analyst's Manual: *Operational Concept Document (Analyst's Manual) for the Advanced Low Altitude Radar Model (ALARM 3.1)*, June 1995, UNCLASSIFIED [6].

Software Design Documentation: *Phase II Accreditation Support Package for ALARM*, September 1995, UNCLASSIFIED [22]. Section 2 of this document provides a Conceptual Model Specification (CMS) for some of the RF sensor functional elements implemented in ALARM. It is still under development as of this writing, but will continue to be incrementally updated.

Related Computer Software Components (CSCs) provided with ALARM 3.1 consist of the following eight items. Each is an ALARM-specific, stand-alone program:

1. BINPRO converts binary data into an ASCII data file for use by plotting software packages.

2. DIMENS aids the user in changing frequently used parameters by modifying the FORTRAN source code. This is an especially useful utility since ALARM uses FORTRAN COMMON blocks, but not INCLUDE files.

3. DMABIO converts DMA DTED to preprocessed file formats so that ALARM can operate efficiently in the site-specific mode.

4. GENANT is used to generate basic two-dimensional and three-dimensional radar antenna patterns.

5. GRAPHIT is used to generate line plots from ALARM output data when the model is executed in Flight Path mode.

6. PDMERG combines multiple binary plot files into one file to simulate capabilities of a radar with multiple beams or multiple radars at a site.

7. PREPGP prepares input files that are compatible with the public-domain GNUPLOT program.

8. PREPXP prepares input files that are compatible with the XPRISM plotting programs available in the KHOROS software developed by the University of New Mexico.

2.3.1 Model Databases

There are two sets of input data currently or soon to be available for ALARM users: unclassified example cases distributed with the code, and classified data developed by Wright Laboratory.

1. Example Cases: ECSRL maintains and distributes through SURVIAC example data sets, along with the model source code. There are 16 separate data sets, complete with inputs and outputs listed in the formal documentation. These are useful for confirming correct installation and operation of ALARM.

2. Classified Cases: Radar data sets for ALARM 3.1 are being developed under the ALARM Red/Gray Database Development and ALARM Blue Database Development tasks under the Electronic Warfare Requirements and Assessment Program (EWRAP) contract held by SAIC with Wright Laboratory. Radar data sets are being developed for four Blue early warning (EW) / target acquisition radar (TAR) systems, nine Gray EW/TAR systems, 26 Red EW/TAR systems, and four height-finder (HF) radar systems under these two tasks. Radar data sets will be developed for approximately two modes per radar system, with the emphasis on the modes of the radar system which provide the best low-altitude detection capability. The primary source of information on the radar systems is the Electronic Warfare Integrated Reprogramming (EWIR) database, with the secondary source of information being the *Radar Handbook* [20]. The radar data sets are scheduled for release through ECSRL. The point of contract for the data sets is Mr. Robert Ehret, Wright Laboratory, WL/AAWA-1, Bldg. 620, 2241 Avionics Circle, Suite 16, Wright-Patterson Air Force Base, OH 45433-7318, (513) 255-4429.

2.4 CURRENT PROCEDURES

ALARM CM substantially conforms to the *ECSRL Software Configuration Management Plan* [7]. The Configuration Control Board (CCB) for the model is responsible for CM and is composed of representatives from several organizations at Wright-Patterson AFB. Representation includes the Aeronautical Systems Center Reconnaissance and Electronic Warfare Program Office (ASC/RW), the Wright Laboratory Electronic Warfare Requirements and Analysis Branch (WL/AAWA), the ECSRL System Manager, and the ALARM Model Manager. Their names and organizations are listed in Table 2.4-1.

Table 2.4-1 ALARM CCB Composition

FUNCTION	POC	ORGANIZATION	PHONE
ECSRL System Manager CCB Chair	Mr. Bill McQuay	WL/AAWA-1	(513) 255-4429
ALARM Model Manager	Mr. Rob Ehret	WL/AAWA-1	(513) 255-4429
Configuration Control Office	Mr. Larry Janning	Principal Investigator, EWRAP contract/SAIC	(513) 429-6641
Configuration Administrator	Mr. Mark Roe	WL/AAWA-1/SAIC	(513) 254-3570

The CCB is the sole authority for approving and disapproving major changes, new beta site requests, and classified database requests. The CCB Chairman makes decisions not requiring a meeting of the CCB.

Configuration control is accomplished through the orderly process of establishing baselines and managing the incorporation of approved changes to those baselines; and the Configuration Control Office (CCO) is responsible for these tasks and consists of personnel from the ECSRL support contractor, SAIC. The CCO interprets and implements the CM planned and directed by the Model Manager, and specified in the Configuration Management Plan. Relationships within the ALARM CCO are depicted in Figure 2.4-1.

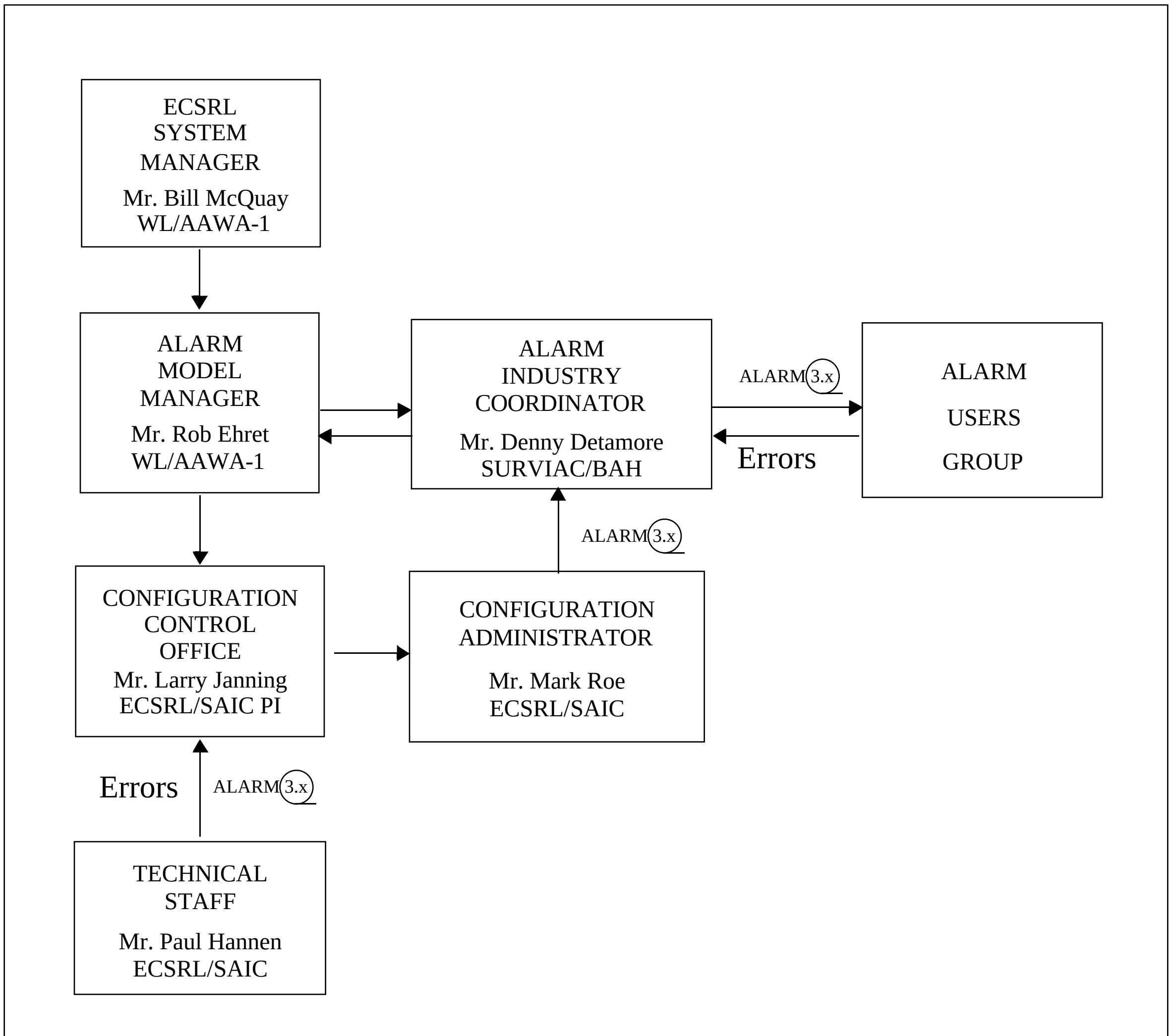

Figure 2.4-1 ALARM Configuration Control

2.4.1 Beta Site Agreements

As part of the CC process, all ALARM user organizations must sign the ECSRL Beta Site Agreement before SURVIAC transmits a copy of the baseline model. (ESCRL refers to users as "beta sites.") Signed agreements are sent to the Configuration Administrator. The Beta Site Agreement binds the entire company or government organization to its terms via signature of an official. Beta sites are authorized to design, code and test modifications to ALARM, provided they report them to the ECSRL CCO in writing within one year of the modification. The government retains unlimited rights to any such modifications and enhancements of ALARM.

2.4.2 Version Designators

New ALARM versions are generated on an as-needed and as-funded basis, historically not more than one release in a calendar year. Under terms of the Beta Site Agreement, only the unmodified official release of the ALARM source code can be called ALARM. Users modifying their version of ALARM must define a modified version designator (e.g., ALARM 3.1m) when reporting results of studies obtained with the altered model.

Prior to ALARM 3.0, version numbers reflected the year of the version release (e.g., ALARM 86). Because SURVIAC uses a sequential number (vice year) to distinguish among versions, the ALARM Model Manager decided to change what would have been ALARM 93 to ALARM 3.0.

ECSRL defines major version releases as those that make fundamental changes to the model's algorithms and/or input data sets. Using SURVIAC's numbering scheme, a new major version number is the next whole number greater than the current version number (e.g., ALARM 4.0). In general, minor version releases are those that fix minor bugs and/or implement enhancements that do not require changes to the input data sets. Minor version numbers are fractional increments of the preceding version number (e.g., ALARM 3.1). In the case of catastrophic errors being found (i.e., the model crashes or cannot be compiled or executed), an immediate fix would be implemented and distributed to the users as a minor version release; this has not occurred to date.

2.4.3 Change Process

The ALARM change process is depicted in Figure 2.4-2. Change reports can be originated by the government or industry user sites. Each report must be completed in detail and submitted to the Configuration Administrator or SURVIAC, who logs receipt of the report and forwards it to the ALARM Model Manager (MM). The MM reviews the report, analyzes the problem and its proposed solution, or an enhancement, and schedules its implementation. There are two categories of changes: Class I changes affect an established baseline; Class II are all other changes, including documentation corrections and code corrections which do not affect software logic, design or mathematical formulation. If the report requires a Class I change, it is documented and scheduled for presentation at the next ALARM Users Group meeting. The Users Group reviews and prioritizes the changes. The MM then reviews the Users Group findings, and with the help of the Configuration Administrator and the Industry Coordinator, submits a report to the ALARM CCB. The CCB approves or disapproves the proposed changes and schedules the changes to be made. Both Class I and Class II changes are implemented by the CCO, then tested by the MM. A standard suite of inputs is used to test ALARM, and this suite is included in the documentation and distributed with the model. Upon completion of successful testing, the new version is sent to SURVIAC for further testing. Problems found by SURVIAC are resolved by the MM. After all testing is complete, the model is distributed to the users by SURVIAC.

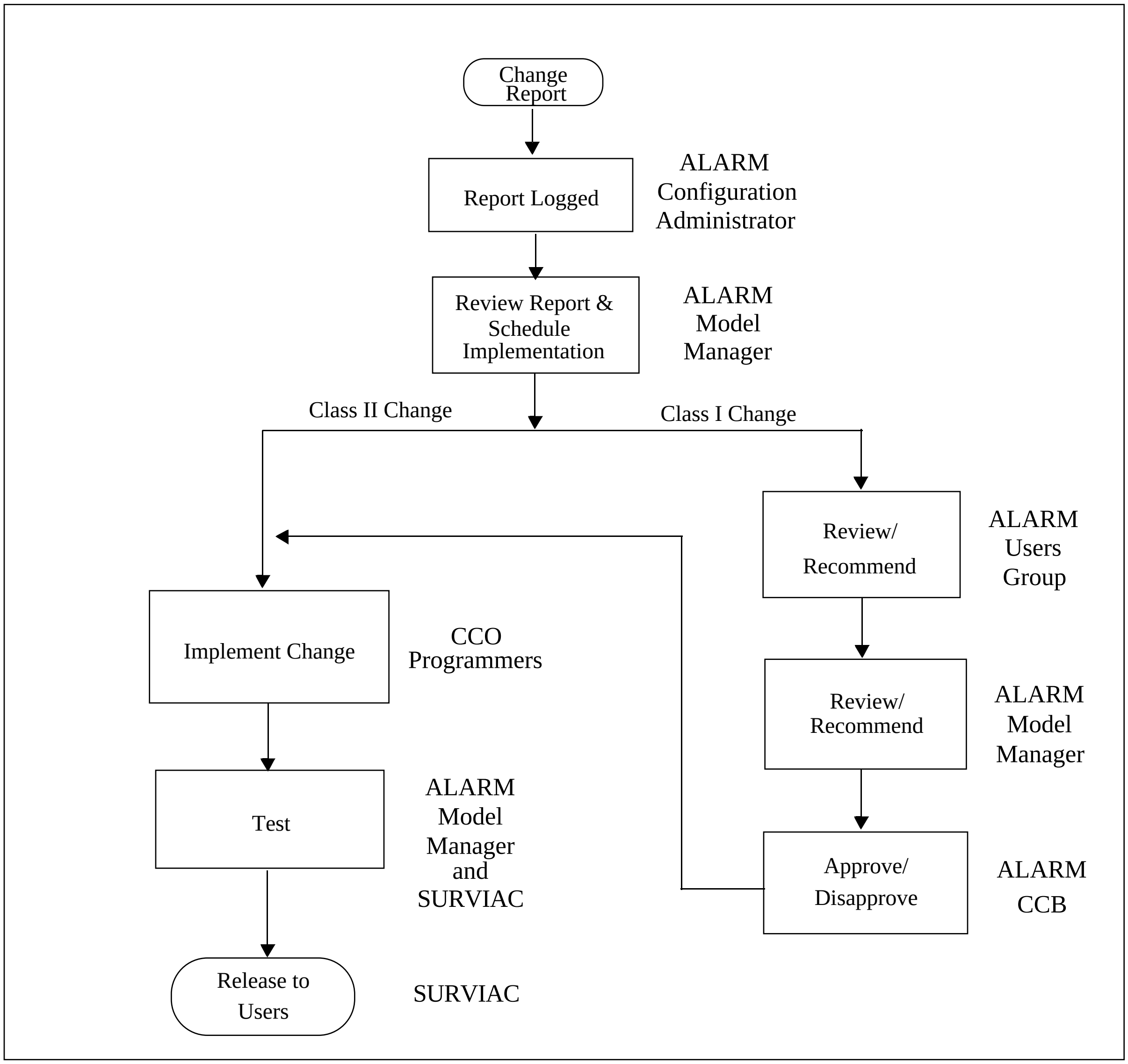

Figure 2.4-2 ALARM Change Process

2.4.4 Change/Error Notification Forms

Appendix G of the *Software User's Manual* [4] contains the ALARM 3.1 Change/Error Notification Form. The form is intended to be used to identify errors and to recommend functional changes to the ALARM baseline. The prerequisite ALARM Beta Site Agreement requires users to notify ECSRL of any errors discovered or functional changes implemented.

2.5 USER SUPPORT FUNCTIONS

SURVIAC sponsors annual ALARM Users Group (AUG) meetings, at which the SURVIAC ALARM manager presents current status of the model and plans for further development. Users present results of ALARM-related studies and applications, and specific changes recommended for inclusion in the baseline are reviewed and prioritized in open discussions with CCB members. These AUG meetings help foster cooperation and understanding among users and the ALARM support staff. There are currently over 100 organizations and companies represented in the AUG, a current listing of which is provided in Appendix B, ALARM Users Group POCs.

The SURVIAC technical point of contact, Mr. Denny Detamore of Booz-Allen & Hamilton, located in Dayton, OH (513) 429-9509, operates a call-in help line for ALARM. SURVIAC may also request assistance from ECSRL's SAIC support staff for problems of significant complexity or special interest. Mr. Detamore can also be reached via fax at (513) 429-9795 or via e-mail at Detamore_Denny@bah.com.

2.6 IMPLICATIONS FOR MODEL USE

ALARM use is widespread among a diverse group of DoD analysts, many of whom support and annual meetings of the AUG. Comprehensive technical support is available to ALARM users from SURVIAC and/or ECSRL, depending upon the nature of problems encountered. There are documented procedures and an established formal structure for the CM and CC of ALARM code and documentation. Current procedures are somewhat dated, but have been targeted for revision in the near future. The actual update and release of source code corrections to known problems depend on funding availability, which can be erratic. The following paragraphs describe some CM implications for ALARM use:

1. **Configuration Management:** ALARM is managed under a rigorous CM and CC process. Users report errors and/or propose changes to the Model Manager, either directly or through SURVIAC. These are reviewed for technical merit and affordability, then implemented according to available funding. SURVIAC is the sole source of distribution for the ALARM baseline. Access to ALARM requires the organization or firm to sign a formal Beta Site Agreement, and anyone making changes to the baseline for further distribution is obliged to change the name of the code.

Implications for use: ALARM CM processes are sufficient to establish the identity of the model version and certification of its outputs.

2. **Control of the Master Baseline Copy:** The ALARM CM process identifies and controls functionality of the baseline, including source code, documentation, utility/support software, and example input data sets.

   Implications for use: Registered users can have confidence in the version control of the code and that support for it is in place.

3. **Timely Processing of Trouble Reports and Change Notices:** Procedures are in place for ECSRL and SURVIAC to provide notice to all users of problems deemed to be technically serious (e.g., when baseline code does not compile, link, or run successfully; when model runs on a user's computer do not generate the same results as in ECSRL; when a user's reasonable input values do not generate reasonable results; or when someone uncovers serious deficiencies in either an algorithm or the implementation of an algorithm). These types of problems usually result in the generation of an immediate fix by ECSRL and transmission of it to SURVIAC for distribution to all registered users. Less critical problems are corrected during the version update cycle.

   Historically, WL/AAWA funding has been available for a biennial ALARM baseline updates. The JTCG/AS has funded ALARM maintenance and development in recent years, which has leveraged other resources for error corrections and test-related enhancements.

   Implications for use: Users are notified of major errors discovered in ALARM; however, they may not be notified of minor errors which could affect the outcome of their studies. Catastrophic problems are corrected immediately, but corrections to other problems may not be made available for a year or longer after the problem is discovered.

4. **Change Notice:** Notice of a baseline change to ALARM is provided through SURVIAC to all users. Documentation is updated with

each new version of the software.

Implications for use: Users are informed of pending baseline updates, and new baselines usually trigger an AUG meeting. Users can be assured of up-to-date documentation.

5. **Version Identification:** All ALARM software, media, and documentation distributed by SURVIAC are identified by a unique version number. User-modified versions of ALARM must be renamed to indicate a change from the baseline.

   Implications for use: Confusion as to ALARM version identification is unlikely.

6. **Control of Approved Changes:** The AUG reviews and prioritizes the proposed changes to any new version of ALARM. This prioritized list is then presented to the CCB for approval, based on government requirements and funding constraints. The developer builds the new version, updating code, documentation, and example data sets as part of the government model manager's tasking. The full set of revised example input data is then exercised using the revised code. Finally, this version of the code, documentation, and data is declared a beta version and released to user beta sites for testing. These participating user sites run their own input data sets against the beta version, and provide results of their runs, including error reports and suggested improvements, to ECSRL. User recommended changes are usually incorporated into the final version of the code, which is again tested against the example input data sets. Upon successful test completion, the new version of ALARM is provided to SURVIAC by ECSRL. SURVIAC then runs its own set of tests against the baseline. When these tests have been completed, the new baseline version is released.

   Implications for use: Changes to an ALARM baseline are clearly identified, reviewed, and controlled. Development of new functionality is performed under existing CM and CC processes. The user can have confidence that no unauthorized changes have been made to the baseline version.

7. **User Assistance:** SURVIAC maintains a help desk available for novice users, with model experts available for more complex problems found by experienced users.

   Implications for use: Users can be assured that ECSRL and SURVIAC experts are available to answer questions and investigate problems.

8. **ALARM Users Group:** There is an active users group of over 100 members, with annual meetings serving as forums for exchanging the latest information about use and status of the model.

   Implications for use: Users can depend on an annual opportunity to exchange ideas about use of the model, to seek advice from a wide range of other users, and to offer opinions about proposed changes to the baseline.

9. **Input Data:** There are 16 example data sets provided with the model, along with documented results. These data can be easily modified to represent most radars of interest to a user. Classified data sets certified by intelligence agencies for Red, Blue, and Grey radar systems are planned to be available from ECSRL in the near future.

   Implications for use: Valid input data are available to users for testing and comparison with their own results .